

# MONTHLY WEATHER REVIEW.

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## INTRODUCTION.

The REVIEW for January, 1895, is based on reports from 3,046 stations occupied by regular and voluntary observers. These reports are classified as follows: 149 reports from Weather Bureau stations; 36 reports from U. S. Army post surgeons; 2,205 monthly reports from State Weather Service and voluntary observers; 31 reports from Canadian stations; 283 reports through the Southern Pacific Railway Company; 525 marine reports through the cooperation of the Hydrographic Office, Navy Department, and "New York Herald Weather Service;" monthly reports from 17 U. S.

Life-Saving stations; monthly reports from local services established in all States and Territories; and international simultaneous observations. Trustworthy newspaper extracts and special reports have also been used.

The WEATHER REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe, but for the present month and unless otherwise specifically noted, the text and the statistical tables are furnished by the Division of Records and Meteorological Data, in charge of Mr. A. J. Henry, acting chief of that division.

## CHARACTERISTICS OF THE WEATHER FOR JANUARY, 1895.

No specially marked features were noted during the month. There was an absence of high winds and destructive gales on the Atlantic coast, but the Lake region was visited by severe gales on two occasions.

The month was generally cold and stormy in the interior,

and the cold was also rather more severe in the Southern States than usual.

Further details for each State and Territory will be found under the head of general weather conditions as reported by State Weather Services.

## ATMOSPHERIC PRESSURE.

[In inches and hundredths.]

The distribution of mean atmospheric pressure reduced to sea level, as shown by mercurial barometers not reduced to standard gravity and as determined from observations taken daily at 8 a. m. and 8 p. m. (seventy-fifth meridian time), during January, 1895, is shown by isobars on Chart II. That portion of the reduction to standard gravity that depends on latitude is shown by the numbers printed on the right-hand border. This Chart also gives the so-called resultant wind directions for this month, based on the data given in Table IX of this REVIEW.

Numerical values of pressure are given in Tables I and V, from which the details heretofore published under this section may be drawn.

### HIGH AREAS.

Ten areas of high pressure are platted on Chart IV. In general these originated in the British Possessions north of Montana, and entered the United States at some point on our northern boundary between W. 97° and W. 115°.

But two areas of high pressure passed below the thirty-fifth parallel during the month, the general course being southeastward until about the fortieth parallel, thence northeastward to the Canadian Maritime Provinces. The usual details of the individual paths are given below.

I.—Was central in the west Gulf States on December 31, 1894. On the morning of the 1st it appeared over the east

Gulf States and Tennessee, and moved thence northeasterly and practically disappeared on the evening of the 3d. Temperatures below freezing were reported throughout Mississippi, Alabama, Georgia, and northern Florida on the morning of the 1st.

II.—On the a. m. map of the 2d pressure had risen quite rapidly in Alberta, with a corresponding fall in temperature. By the morning of the 3d the area of high pressure had pushed south and eastward, overspreading Montana and the Dakotas. The area of temperature fall, however, was not coincident with or in advance of the front of the high, but rather in the rear of it, and we also note the rather unusual phenomenon of an extensive area of warm air to the southwest, extending from the Pacific Ocean to the eastern slope of the Rocky Mountains, and covering the plains to the southeast of Colorado as far as Amarillo. We have also here an excellent example of a true föehn wind, confined to the region of central Colorado on the eastern slope of the Rocky Mountains. Eastward on the plains of western Kansas and Nebraska the chilling effect of the high is manifest and the farther advance of the warm air from the Pacific is effectually barred. The movement south and filling up of a North Pacific low is well illustrated in the present case.

By the evening of the 3d the high extended in the shape of an elongated oval from Assiniboia to Kansas and the central Mississippi Valley. The region of greatest temperature

fall covered Minnesota on the eastern side of the area of highest pressure, and by the a. m. of the 4th had moved south and east, covering eastern Iowa, northern Illinois, northwestern Indiana, Wisconsin, and a portion of Upper Michigan. The farther progress of the high eastward was not attended by marked temperature changes.

III.—This appeared in Alberta on the morning of the 6th. Pressure increased rapidly during the day, a rise of 0.52 of an inch in twelve hours being registered at Edmonton. High pressure continued in Alberta and Assiniboia, and by the morning of the 7th had spread over the northeastern Rocky Mountain slope and the Missouri Valley. The area of greatest temperature fall, on the morning of the 7th, extended as a narrow belt from southern Idaho northeastward through central Montana. By the p. m. of the 7th the area of high pressure had moved southeastward, the central area being partially inclosed by the isobar 30.8, open to the northward. The area of greatest temperature fall occupied three separate and distinct positions, from 300 to 400 miles apart. No. 1 occupied Nebraska and a portion of South Dakota on the southern edge of the central portion of the high; No. 2 a small oval in northwestern Texas, and No. 3 extended as a belt about 150 miles wide on the front of the high, extending from Palestine to Louisville. The maximum intensity of the high was reached by the morning of the 8th; pressure 30.90 at Omaha. Two extensive areas of temperature fall, extensions of Nos. 1 and 3 noted above, appeared on this map, separated by a band of less than 20° fall about 250 miles in width. The farther progress of the high can be traced from the chart.

IV.—This appeared on the morning of the 8th north of Assiniboia and moved eastward, probably uniting with No. III during the p. m. of the 9th in the Lower Lake region.

V.—This was first noted on the a. m. map of the 10th in Saskatchewan. Pressure increased rapidly and the southerly movement began on the night of the 10th. On the morning of the 11th the high occupied Saskatchewan, eastern Assiniboia, Manitoba, eastern Montana, the Dakotas, and western Minnesota. The areas of greatest temperature fall covered central Montana, the western edge of the Dakotas, and a small portion of central Minnesota. During the day the cold area spread rapidly eastward and southward, covering South Dakota, Nebraska, northeastern Kansas, Iowa, northern Missouri, northern Illinois, Wisconsin, and Minnesota. The isobar of 30.70, open northward, marked the region of highest pressure, viz, in North Dakota and Manitoba. On the morning of the 12th the central high had moved but little, although the area of cold had spread rapidly eastward and over the Ohio Valley and the Lower Lake region to central Ohio. At 8 p. m. of the 12th pressure had decreased at the center, but the form of the isobars remained unchanged, except for the lengthening of the southern loops. The area of cold extended from western Texas to western North Carolina and western Pennsylvania, and by the morning of the 13th had swept over the Southern States, carrying freezing temperatures to the Gulf coast from central Texas eastward. Zero temperatures were reported in the upper Ohio Valley, West Virginia, and Pennsylvania.

VI.—This appeared over the north Pacific coast on the evening of the 12th, and moved slowly eastward over the northern plateau. On the morning of the 15th pressure had increased slightly over northwestern Wyoming and southwestern Montana, and an extensive area of temperature fall appeared on the eastern edge of the high. Temperature had been falling, however, for twenty-four hours, but the limit which constitutes a technical cold wave was not reached over any considerable extent of country. By the evening of the 15th the high had broken into two portions, and by the morning of the 16th three separate centers of high pressure appeared—one in

Assiniboia and Montana, another in Wyoming, and a third in eastern Kansas. No marked features attended the progress of the third center to the Atlantic.

VII.—This formed in the rear of low area No. VIII on the morning of the 18th. It covered the central valleys as an extensive ridge of high pressure, with a maximum in the Upper Lake region on the morning of the 19th. Its subsequent course is shown on Chart IV. The temperature-fall area in connection with this high was confined to a small portion of Virginia and Maryland on the morning of the 20th.

VIII.—High area No. VIII is charted as originating in Saskatchewan on the morning of the 22d. Pressure rose throughout the central plateau region on the 20th, and at the evening observation of that date formed a ridge extending from Nevada northeastward to Assiniboia between two adjacent areas of lower pressure.

This ridge extended southward and changed its position with reference to the longer axis, and on the evening of the 21st covered the entire Rocky Mountain region with maximum pressure 30.30 at Cheyenne. By the morning of the 22d the southern extremity of the ridge had swung eastward over the west Gulf States, and an extensive area of temperature fall covered the Mississippi and Ohio valleys in the rear of low area No. IX. At this time pressure was rising in Alberta and Saskatchewan, and high area No. VIII began to move eastward. The area of temperature fall in connection with this high appeared in the western quadrant until the evening of the 23d, when it occupied Kansas and Oklahoma, the center of high pressure being in North Dakota. On the succeeding maps the central portion of the high seemed to recede into Manitoba and Assiniboia, where a new center with closed isobars appeared on the evening map of the 24th; long loops of high pressure, however, extended to the Atlantic coast, and on morning of the 25th an independent high, No. VIIIA, was formed over New Jersey and passed northeastward, as shown by Chart IV.

IX.—Appeared in Saskatchewan on the morning of the 26th, with a narrow V-shaped area of temperature fall projecting southward to Miles City. There was also a triangular-shaped area of temperature fall in eastern Texas, Louisiana, Arkansas, Mississippi, and southern Missouri, caused by an inflow of cold air in the rear of low area No. X. By the morning of the 27th a ridge of high pressure extended from Tennessee to the northern plateau region. Small areas of temperature fall occupied western Montana, southern Wyoming, Wisconsin, the Lower Lakes, and the south Atlantic coast.

X.—This was an offshoot from the permanent high over the central plateau that advanced in the rear of low area No. XIa.

XI.—This appeared on the morning map of the 31st, coincident with a considerable fall of temperature over Assiniboia and western Montana. It moved very rapidly southeastward and was central in South Dakota and Colorado at 8 p. m. of the 31st. The area of temperature fall in this case occupied the rear of the central high covering eastern Montana and Wyoming, and the western and southern portion of the Dakotas. Singularly, the 20-degree fall had not yet reached St. Vincent and Huron, although it had passed Moorhead and Yankton, respectively. The further details of this high will appear in the February Review.

#### LOW AREAS.

The average rate of movement of low area storms in January is 37 statute miles per hour and the average number that traverse some portion of the continent is thirteen.

The tracks of fourteen areas of low pressure are plotted on Chart I for January, 1895. The rate of movement of this class of storms is always uncertain and the storms of the present month are no exception to the general rule. Exam-

ples of the tendency to stagnate in the region of the Great Lakes may be seen in low areas Nos. II, IX, XII, and in No. V the unusual example of a storm retrograding after having passed the Great Lakes is seen. The path of this remarkable storm presents many anomalies, and a study of its course is commended to all. Low area No. X likewise illustrates the difficulty of successfully forecasting storm movement. It will be noted that this depression remained almost stationary over Texas for thirty-six hours, and that when it began to move it passed from Corpus Christi to Saugeen, Ont., in thirty-six hours.

The storms of the Pacific Coast present a characteristic that is worthy of special study, viz, an apparent oscillation from the ocean to the land, and *vice versa*, that is to say, the low approaches the coast and partially disappears, reappearing within a period of twelve to thirty-six hours, and continuing this action until the storm finally disappears.

The usual details of the more important low area storms are given below:

I.—The morning map of the 1st showed a slight depression over the Lower Lakes, and an ill-defined area of low pressure on the New England coast, separated from the former by a slight ridge of high pressure, with zero temperature in interior New England. These two areas united during the day, and on the evening map appeared as a well-defined area of low pressure central over Nova Scotia. Pressure increased during the night of the 1st and the storm gradually moved to the northeast.

II.—This appeared on the evening of the 1st, north of Minnesota. It drifted slowly eastward attended by snow in the Lake region, and finally passed to the eastward of Nova Scotia by the morning of the 5th. The movement of high area No. I northeastward on the 3d, apparently checked the progress of this storm while in the Lake region.

III.—This was an area of relatively low pressure that skirted the east Gulf States and passed off the coast of Georgia on the morning of the 3d. Precipitation was general on the 2d throughout the Gulf, south Atlantic, and Middle States, continuing on the coast until the morning of the 3d.

IV.—On the morning of the 2d a well-defined area of low pressure appeared off the north Pacific coast. Pressure was high over British Columbia and Alberta. By evening the area of precipitation had extended to Rapid City, while a moderate cold wave overspread Alberta, Assiniboia, and Manitoba. On the morning of the 3d, the area of high pressure and accompanying cold wave had pushed south and southeastward and occupied Montana and the Upper Missouri Valley; both temperature and pressure gradients to the westward of the high were unusually steep. A portion of the north Pacific low had apparently been separated from the main storm and appeared as an area of relatively low pressure over the Panhandle of Texas. By evening the central portion of the high extended from Swift Current to Des Moines and the Panhandle low had been pushed farther south to central Texas. The north Pacific low in the meantime was developing in intensity, pressure having fallen to 29.1 at Tatoosh Island. On the morning of the 4th the high occupied the central valleys and dominated the weather conditions over the greater portion of the United States. The north Pacific low was still central at Tatoosh Island, although pressure had begun to fall over the northern plateau. The evening map showed an extensive warming up over the eastern slope of the Rocky Mountain region and a projecting wedge of low pressure extending over Montana and the Dakotas. Precipitation had already begun in Kansas and Missouri, though not in the intervening States. On the morning of the 5th pressure had increased to 29.3 inches at Tatoosh Island; the wedge of low pressure over Montana had become separated from the parent storm, forming a new storm center, the second that had be-

come detached from the north Pacific low. This offshoot passed eastward, following the usual track across the Great Lakes and down the St. Lawrence Valley, and disappeared on the evening of the 7th. The original storm center gradually filled up and by the morning of the 6th had almost disappeared.

V.—This was the most erratic storm of the month, both as regards direction and rate of movement. It was evidently formed at the lower extremity of an extensive trough of low pressure that extended from Texas to the Lake region on the morning of the 7th. The evening map of the 7th showed a slight depression central in the west Gulf. An extensive area of high pressure was advancing from the northwest with clear weather and zero temperature. The temperature gradients northward from New Orleans were regular but pronounced, being 5° per latitude degree to the northern boundary at St. Vincent. For forty-eight hours the storm skirted the Gulf coast, giving rain in the northern and eastern and snow in the northwestern and western quadrants. The high area mentioned above as advancing from the Northwest, curved to the northeast when central over Kansas and Missouri, and while over the lower St. Lawrence Valley, with pressure 30.60 at Montreal and Northfield, the low which had been almost stationary in northern Florida for twenty-four hours, suddenly curved inland, and by the morning of the 10th was central in eastern Kentucky and Tennessee. The storm moved rapidly northeastward for twenty-four hours increasing in intensity and reaching a point near Georgian Bay, when it suddenly altered its course and moved to Grand Haven by the evening of the 11th. The data on the map afford no clue to the causes of this backward movement. An area of high pressure was advancing toward Grand Haven on the west, pressure had fallen over the Canadian Maritime Provinces, and there was every reason to believe the storm would pursue the usual course.

The morning map of the 12th showed the storm center near Parkersburg with an extensive cold wave in its rear. The temperature contrasts between the front of the cold wave and the rear of the storm center, were exceedingly sharp, being as much as 42° in less than 150 miles. By the evening of the 12th the storm center had reached the Atlantic coast in the vicinity of Norfolk, and thence pursued a northerly course, disappearing by filling up on the morning of the 14th. This was one of the most remarkable January storms ever experienced, and is deserving of further notice. In its inception and full development the temperature contrasts in the western and southwestern gradients were unusually sharp.

VI.—This developed on the north Pacific coast between the 10th and 12th, moved across the United States almost parallel with the northern boundary, and passed beyond the field of observation on the 17th.

VII.—The warming up in the west Gulf on the 14th, and the formation of an area of cloud and rain, indicated a disturbance in that region although the pressure distribution and the circulation of the wind did not fully corroborate it until the evening of the 15th. The rain area had then extended as far northeast as lower Indiana and Illinois. This depression gave light rains in the Gulf and Atlantic coast States, and moved rapidly to the northeastward, passing south of Nova Scotia on the morning of the 17th.

VIII.—Pressure was low on the Pacific coast on the 14th, but without precipitation or storm winds. It continued falling rapidly on the 15th, and by the morning of the 16th had decreased over the entire country west of the one hundred and fifteenth meridian. Rain had fallen from Fort Canby to Tucson. By the morning of the 17th the precipitation area had extended eastward to central Montana and southward to Lander and Salt Lake City. The warming up on the eastern slope of the Rocky Mountains, the visible indication of the transfer-

ence of the low to the eastern side, first appeared on the morning map of the 17th. By the morning of the 18th a well-defined system of circulating winds around a central area of low pressure appeared in Iowa and moved eastward passing off the coast of New Brunswick on the night of the 19th.

IX.—The origin of low area No. IX is given as eastern Wyoming. There is no evidence, however, that it was not an offshoot of a low pressure area on the Pacific coast which followed No. VIII. This storm developed as it approached the Great Lakes, and gave the first severe stormwinds of the month. It decreased in severity after passing the Lakes and passed beyond the region of observation as a very moderate disturbance.

X.—This appeared on the morning of the 23d as an ill-defined area of low pressure over central Texas. It developed very slightly and remained almost stationary during the next thirty-six hours, but the morning map of the 25th showed a rapid movement and an increase in intensity. By the morning of the 26th pressure had fallen to 29.04 at Saugeen, and the storm had moved 1,500 miles in thirty-six hours; in its further course it gradually diminished and passed down the St. Lawrence Valley as a storm of moderate energy.

XI.—This belongs to that class of storms that occasionally pass from the Pacific along the southern border of the United States and up the Atlantic coast. On the morning of the 27th an extensive ridge of high pressure extended from eastern Tennessee to western Montana. Pressure was lowest on the south California coast. Rain was falling in Arizona and rain and snow in Texas. Twelve hours later the precipitation area covered the greater part of New Mexico, Texas, and Louisiana; the south California low had deepened slightly, and the ridge of high pressure had advanced to the southward, doubtless causing the extensive precipitation of rain and snow in Texas and New Mexico. By the morning of the 28th the ridge of high pressure had broken into two parts, one central over the middle plateau, the other over the Ohio Valley. The southern California low had lost energy and an independent storm center appeared in the central Gulf. The temperature throughout the Lower Mississippi Valley and the Gulf States was below the normal for the season, and extensive snows prevailed from Kansas and Oklahoma eastward to central Tennessee. The low drifted eastward rapidly and passed up the Atlantic coast, giving rain on the immediate coast and heavy snow in the interior.

XII.—This appeared in Alberta on the evening of the 27th, and passed rapidly southeastward until reaching the Lake region. Here, as sometimes happens, the rate of movement was much reduced, and the storm occupied the Lake region for about thirty-six hours.

XIII.—This appeared in the Saskatchewan Valley on the evening of the 29th as an ill-defined depression, and at no

time in its course did it develop stormwinds or extensive precipitation.

XIV.—This appeared off the west Florida coast on the evening of the 29th. It remained almost stationary over the Florida Peninsula until the evening of the 31st, giving heavy rains on the coast as far north as New Jersey.

#### MOVEMENT OF CENTERS.

The following table shows the date and location of the center at the beginning and ending of each area of high or low pressure that has appeared on the U. S. Weather Maps during the month, together with the average daily and hourly velocities. The monthly averages will differ according as we consider each path as a distinct unit, or give equal weight to each day of observation; in the first case the monthly average is taken by paths, in the latter case by days.

*Movement of centers of areas of high and low pressure.*

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
<b>High areas.</b>										
I.....	1, a.m.	35	85	3, a.m.	43	68	Miles.	Days.	Miles.	Miles.
II.....	2, a.m.	52	113	5, a.m.	44	61	1,100	2.0	550	23.9
III.....	6, a.m.	54	112	10, p.m.	47	58	2,900	3.0	967	40.8
IV.....	8, a.m.	54	104	9, p.m.	46	76	3,500	4.5	778	32.4
IVa.....	8, a.m.	39	114	12, p.m.	39	112	1,500	1.5	1,000	41.7
V.....	10, a.m.	55	108	13, a.m.	51	87				
VI.....	13, p.m.	47	123	18, p.m.	32	78	1,400	3.0	467	19.5
VII.....	18, a.m.	39	101	20, p.m.	32	78	3,200	5.0	640	26.7
VIII.....	22, a.m.	55	87	23, p.m.	44	98	2,400	2.5	960	40.0
VIIIa.....	25, a.m.	42	74	26, a.m.	46	60	2,400	1.5	1,600	66.7
IX.....	26, a.m.	55	119	28, p.m.	39	70	900	1.0	900	37.5
IXa.....	28, a.m.	44	117	31, a.m.	45	114	3,200	2.5	1,280	53.8
X.....	30, a.m.	38	99	31, p.m.	45	97	1,900	1.5	1,267	52.8
XI.....	31, a.m.	40	113	31, p.m.	46	101	600	0.5		
Sums.....							25,000	28.5	10,409	
Mean of 11 paths.....									946	39.4
Mean of 28.5 days.....									877	36.5
<b>Low areas.</b>										
I.....	1, a.m.	43	69	1, p.m.	48	63	600	0.5		
II.....	1, p.m.	50	97	5, a.m.	47	58	2,200	3.5	629	26.2
III.....	2, a.m.	29	98	8, a.m.	33	75	1,000	1.0	1,000	41.7
IV.....	2, a.m.	49	130	5, p.m.	45	125	700	3.5	100	4.2
IVa.....	5, a.m.	45	104	7, p.m.	49	62	2,500	2.5	1,000	41.7
V.....	7, p.m.	27	95	14, a.m.	46	77	3,900	6.5	600	25.0
VI.....	10, a.m.	50	126	17, a.m.	47	58	3,200	7.0	429	17.9
VII.....	15, a.m.	26	96	16, p.m.	42	61	2,300	1.5	1,533	63.9
VIII.....	14, p.m.	44	127	18, a.m.	47	122	800	3.5	114	4.8
VIIIa.....	17, p.m.	87	101	19, a.m.	40	72	1,800	1.5	1,200	50.0
IX.....	19, p.m.	43	107	23, a.m.	45	60	2,700	3.5	771	32.1
X.....	23, a.m.	28	98	27, a.m.	51	61	3,000	4.0	750	31.2
XI.....	27, a.m.	34	118	28, a.m.	31	116	350	1.0	350	14.6
XII.....	27, p.m.	54	111	30, p.m.	50	65	2,400	3.0	800	33.3
XIII.....	29, p.m.	51	113	31, p.m.	47	85	1,500	2.0	750	31.2
XIV.....	29, p.m.	29	84	31, a.m.	31	76	450	1.5	300	14.5
Sums.....							29,400	46.0	10,326	
Mean of 15 paths.....									688	28.7
Mean of 46 days.....									639	26.6

#### NORTH ATLANTIC METEOROLOGY.

*[Pressure in inches and millimeters; wind force by Beaufort scale.]*

##### NORMAL CONDITIONS.

The normal barometric pressure for January over the North Atlantic Ocean, as deduced from international simultaneous meteorological observations taken at Greenwich noon and not reduced to standard gravity, is highest, 30.20 (767), in a small area between the Azores and the Windward Islands; it is lowest, 29.50 (749), in a region between Greenland, Iceland, and Spitzbergen. As compared with December the normal pressure for January rises about 0.05 in the region southwest of the Azores, but falls in the extreme North Atlantic.

##### OCEAN FOG.

The limits of fog belts west of the fortieth meridian, as reported by navigators, are shown on Chart I by dotted shading. Near the Grand Banks of Newfoundland fog was reported on 20 dates; between the fifty-fifth and sixty-fifth meridian on 6 dates; and west of the sixty-fifth meridian on 3 dates. Compared with the corresponding month of the last seven years the dates of occurrence of fog east of the fifty-fifth meridian numbered 13 more than the average; between the fifty-fifth and sixty-fifth meridians 3 less than the average; and west of the sixty-fifth meridian, 3 less than the average.